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## DELTA SMELT

Effects of EWA operations on delta smelt were analyzed using salvage numbers. This was used as a rough indicator of effects on populations. A population-level analysis of effects on smelt is not possible at this time.

Adult smelt salvage was reduced in the gaming. Primary protective actions were export reductions and increases or decreases (to back water up) in delta outflow, typically in the January through March period. These actions often coincided with salmon presence, providing simultaneous benefits to both species.. Games 4 and 5 provided the largest reduction in adult salvage (40 and 37%, respectively) compared to historical numbers. On average, prescriptive standards provided slightly better reduction (30%) in adult smelt salvage, but the gaming exercises were also effective in reducing salvage (27%) from historical levels.

Smelt juveniles, typically present in April through July, benefitted from the gaming in some years of each game. However, in many instances gaming did not reduce salvage below historic levels because pumping rates used in the simulation were much higher than historic rates. Actions to protect smelt juveniles include export reductions and San Joaquin basin inflow increases before and after the VAMP period. Overall the gaming exercises increased smelt salvage by 3% over historic levels. Values for each game ranged from a salvage increase of 19% for game 1 to a decrease of 23% for game 2. The prescriptive standards were much more effective in reducing salvage, averaging a 54% reduction.

In several years gamed, we made the assumption that actions taken prior to VAMP (increased flows, reduced exports, and improved X2) would result in less juvenile delta smelt within the zone of influence of the pumps. Consequently, we allowed pumping at higher levels than strict interpretation of the salvage data would have recommended. If we assumed correctly that fish densities would have been less after the VAMP period, actual operations would have provided greater protection for juvenile delta smelt than are indicated by our gaming results. If the fish remained in areas under influence of the pumps despite EWA protective actions (as they did in 1999), significantly more EWA water would have been necessary to provide adequate protection.

Conclusion: Although the prescriptive standards were generally more protective overall than the gaming exercises, it appears that an EWA with sufficient assets has the potential to provide substantial benefits to delta smelt. EWA assets particularly needed for smelt are (a) the ability to reduce exports in the Jan-Mar period for adult fish, and in the April-June period for juveniles, and (b) the ability to provide inflows from the San Joaquin basin during the same time period.

## SPLITTAIL

Gaming exercises proved to be protective of splittail. The primary measures used in EWA gaming to protect splittail were reduction of exports and increase in outflow during the spring/early summer period. Most actions to protect splittail were taken concurrent with actions for delta smelt young. However, in all the games we provided protections specifically for splittail by reducing exports in 1995, when historically over 4 million fish were salvaged at the pumps. In this critical year for splittail, gaming results show that salvage was at least reduced to a level which matched the historic level. On the average, gaming exercises reduced salvage from historic levels by 34%, while the prescriptive standards provided a 61% reduction.